

Temperature and Relative Humidity Dataloggers

This paper is based on research of the sources available on the internet. The overview and list of the dataloggers was based primarily on price and technical specifications, not the accompanying software. Most of the manufacturers provide extensive technical information while software is usually described in very general (and glowing) terms. It is quite difficult to find common denominators to compare. All that can be said is, that they all have software that enables upload of data to computer and presentation of that data in the form of a chart or table. The notable exception is the Image Permanence Institute, since, their software (and datalogger) was developed “specifically for preservation use in cultural institutions” (PEM Operator’s Manual) so that it is not really comparable with others in scope and price.

The list of datalogger manufacturers was compiled from:

- the list of the Dataloggers, Sensors, Measurement, and Monitoring Equipment suppliers listed on web site Conservation OnLine (<http://palimpsest.stanford.edu/>);
- manufacturers suggested in article by Patricia Morris “Setting Up an Environmental Monitoring Program” published 2004 in *Colorado Libraries*;
- list of dataloggers from article by Rachel Perkins Arenstein published in 2001 in *Conserve O Gram*;
- the summary of answers to the inquiry about temperature and relative humidity monitoring equipment posted by Janette Gomes.

It is hard to say how many sampling stations would be necessary to comprehensively monitor storage space in UCR Special Library. There are no formulas giving a datalogger/space ratio. In response to an e-mail inquiry about recommended number of sampling stations for given space, Jim Urich from Pinnacle Technology Inc. wrote :

“There is no formula for number of dataloggers per square foot. You may have several microclimates within your room, especially if it has poor air circulation, is against an outside wall, or has many doorways opening to the room. If you have microclimates within your room, the Temp. & humidity should probably be monitored there. The value of what you are storing should also be considered, e.g. rare books.”

In her article Morris gives a similar recommendation:

“Where ... should you place your environmental monitoring devices? At least one should be placed in the midst of the collection storage area, not next to the air

supply vent. Sensors read the conditions in their immediate vicinity. If there is an area within the collections where you feel there might be a problem, place a monitor there, e.g. near a large expanse of windows or in an area where mold or mildew has occurred. Don't place the sensor too close to machinery like a photocopier, the machine and the people ... will have a surprising impact on your temperature and humidity readings. But if there is a bank of computer work stations in the stacks, you may want to monitor conditions there." (p.32)

On the Image Permanence Institute web site in their environmental monitoring tutorial (http://www.imagepermanenceinstitute.org/shtml_sub/ht_pem.shtml), they recommend to put their PEM dataloggers:

- in indoor areas, including cold vaults, sealed but unheated buildings, and storage and display areas. Not outdoors.
- in the same environment that collections experience.
- in areas that hold the most important or most vulnerable collections.
- in each storage or display area where the environment is likely to be different from others because of HVAC systems or special circumstances.
- midway between the floor and the top shelf or ceiling.
- away from outside doors, air vents, radiators, cold walls, fans, or other direct sources of heated, cooled, dehumidified, or humidified air.
- out of direct sunlight.

At this point it is estimated that the UCR Special Collection will need a minimum number of three (3) sampling stations: one in the vault and two in main shelving area. Appendix B presents a detailed list of dataloggers with links to their product pages and manuals. A table comparing dataloggers by their technical features and prices is in Appendix C.

Summary

By all accounts, the two best dataloggers for monitoring and analyzing environmental data in archival setting are:

1. Preservation Environment Monitor (PEM) produced by Image Permanence Institute. System includes Climate Notebook software which enables very sophisticated data analysis and projections. The PEM is developed in research laboratory at Rochester Institute of Technology, New York through a grant from the Division of Preservation and Access of the National Endowment for the Humanities. System uploads data into a computer using a memory card which is inserted into a slot of the datalogger. Data is transferred from the card via SRAM card readers, commonly built-in laptop computers. The full system requires: datalogger, memory card and software. Minimum price with 3 dataloggers: \$2,550.
2. Internet Datalogger/TRH (ID), produced by Pinnacle Technology, Inc. System includes software that show easy-to-read daily or long-term trends and have ability to interface with CADgraphic. The product was developed on request of Cornell

University in 2001. System uploads data into a computer via telnet and could be called up continuously or upon request. System use serial port for initiation and standard 10Base-T Ethernet connection. The full system requires: datalogger. Minimum price with 3 dataloggers: \$2,025.

Oakton Instruments and Fourier Systems offer two very similar wireless data uploading systems:

1. MicroLogPlus, produced by Fourier Systems Ltd. This system offers two models of TH dataloggers – 8 and 10 bit data resolution – which both have option of wireless (radio frequency or infrared) or cable data uploads. Wireless system requires the MicroLog Plus software which is designed to wirelessly monitor sampling stations from a remote PC and get a graphic display of the history of the recorded data of each MicroLog. The full system for RF wireless communication requires: datalogger, wireless transmitter cradle, wireless receiver with antenna and software. Minimum price for 10 bit model with 3 dataloggers: \$1,380.
2. TH TempLog, produced by Oakton Instruments. System has option of data upload via wireless (RF or IRDA) or serial cable connection. The software which is included with the purchase of wireless receiver has a color-coded interface which is used to program and monitor individual dataloggers. The full system for RF wireless communication requires: datalogger, wireless transmitter cradle, wireless receiver with antenna and software. Minimum price with 3 dataloggers: \$1,320.

The most widely used dataloggers in archives and museum are various HOBO and Dickson models:

1. HOBO H14-001 with LCD, produced by Onset Computer Corporation. System requires BoxCar Pro 4.3, a powerful Windows-based program with extensive features for graphing, data analysis, data export and simultaneous management of multiple loggers. System uploads data to PC or Palm OS via serial cable (included with software). The full system requires: datalogger and software. Minimum price with 3 dataloggers: \$696.
2. TP120 TH datalogger, produced by Dickson. System requires DicksonWare software which calculates Min, Max and Average of all data collected. A snapshot of graphs can be easily exported to other programs such as Excel or PowerPoint. System uploads data to PC via serial cable included with software. Full system requires: datalogger and software. Minimum price with 3 dataloggers: \$676.

The smallest and cheapest are LogTag and Lascar dataloggers:

1. HAXO-8 TH, produced by LogTag Recorders Ltd. The datalogger is size of the credit card and weight 35g. System requires LogTag Analyser software provides automatic download of data, display and printing of data in chart, list or summary form. System uploads data to PC via docking station which is connected to

computer via USB or serial cable. Full system requires: datalogger, software and docking station. Minimum price (1 datalogger): \$252.

2. EL-USB-2, produced by Lascar Electronic. The datalogger is 4 in long and 1 in wide and with its plastic protection of USB connection, it resembles thick highlighter. System includes software with strip chart and ability to export to Excel. System uploads data to PC via USB connector (like flash cards). Full system requires: datalogger and software. Minimum price (1 datalogger): \$240.

Appendix A provides detailed information about all models, their prices by items and web links to the product information or manuals.

Appendix B compares products by their technical details and prices.

Appendix C lists some of the environmental monitoring literature available on the internet.

Reference List

Gomes, J. (November 20, 2006). Environmental Monitoring equipment – summary (e-mail). *The Archives and Archivist (A&A) List* (listserv).

Morris, P. (2004). Setting Up an Environmental Monitoring Program. *Colorado Libraries*, 30(3), 31-33. (from Wilson Web)

Perkins Arenstein, R. (2001). Datalogger Applications In Monitoring The Museum Environment, Part I: Comparison Of Temperature And Relative Humidity Dataloggers. *Conserve O Gram*, 3(3). Retrieved January 9, 2006.
<http://www.cr.nps.gov/museum/publications/conservoogram/03-03.pdf>

SoliNET. *Environmental Specifications for the Storage of Library & Archival Materials*. Retrieved January 8, 2007, from <http://www.solinet.net/emplibfile/environspec.pdf>

Urich, J. *Re: Internet Datalogger/TRH - how many?* E-mail to Vlasta Radan. January 11, 2006.

Appendix 1

A DETAILED LIST OF DATALOGGERS

Internet Datalogger (ID) - Pinnacle Technology, Inc.

Product page: <http://www.pinnaclet.com/products/html/datalogger/datalogger.html>

Product manual: <http://www.pinnaclet.com/products/dataloggers/idtrhop10-17.pdf>

From product manual: “The only hardware necessary [to install ID] is a standard AC outlet, a serial connection for initial configuration and an Ethernet connection.” (p.19) Most of the new computers have this connections already installed. Price of datalogger includes software. Unit is powered by AC with battery clock backup. System has ad-on sensor capability.

Datalogger	\$675
Additional LED display	\$25
3 loggers set	\$2,025

From Abbey News, February 2001.

(<http://palimpsest.stanford.edu/byorg/abbey/an/an24/an24-5/an24-507.html>)

“Cornell wanted a web-based datalogger, but couldn't find one on the market, so they asked Pinnacle Technologies to develop one for them. The result was the ezLogger/TRH, which can be checked from any remote computer via the Internet, and which e-mails alarms whenever limits for temperature and relative humidity are exceeded. (It is described on p. 21 of *Paper Conservation News* for December. For details on this new instrument, call Mrs. Joan M. Brink at Cornell at 607/255-4877.) “

Additional opinions about the product:

ConsDisList: e-mail from Joan M. Brink, Conservation Liaison Specialist and Network Administrator, Dept. of Preservation & Conservation, Cornell University, (2000) <http://palimpsest.stanford.edu/byform/mailling-lists/cdl/2000/0639.html>

Archives & Archivist list serv: e-mail from Peter Hirtle, (2001)
<http://listserv.muohio.edu/scripts/wa.exe?A2=ind0101e&L=archives&P=13825>

Preservation Environment Monitor o Image Permanence Institute

Product info http://www.imagepermanenceinstitute.org/shtml_sub/cat_hardsoft_pem.shtml

Product specifications http://www.imagepermanenceinstitute.org/shtml_sub/PEMinfo.pdf

System components <http://www.climatenotebook.com/shopcart/Results.asp?category=14>

From product page: “PEM)is a highly accurate electronic datalogger designed specifically for environmental monitoring in cultural institutions... Climate Notebook software must also be purchased to analyze the data collected by the PEM. PC users will require an external card reader ... and an SRAM memory card. Users of laptops with PC card slots will need only the memory card. The PEM collects and stores temperature and humidity data and uses two specially calculated indices for measuring the natural aging of organic materials. Data can be stored for up to five years and is easily collected and transferred to your computer for analysis with ... software. The PEM uses highly accurate temperature and humidity sensors and comes standard with a NIST-traceable certificate of calibration. “

PEM	\$650	http://www.climatenotebook.com/shopcart/Details.asp?ProdID=34&category=14
Software	\$500	http://www.climatenotebook.com/shopcart/Details.asp?ProdID=26&category=14 + \$125 for installation on every additional computer
Card	\$100	http://www.climatenotebook.com/shopcart/Details.asp?ProdID=36&category=14
Total	\$1,250	(without PC card reader)
3 dataloggers set	\$2,550	
PC card reader	\$375	http://www.climatenotebook.com/shopcart/Details.asp?ProdID=35&category=14

Microlog Wireless Communications – Fourier Systems Ltd.

US Master Distributor: Caritex International Inc.

Product info: http://www.fouriersystems.com/products/wireless/data_logger.php

Software info: http://www.fouriersystems.com/products/temp_humid_8bit/software.php

From product info: “The Microlog Wireless System enables advanced RF wireless communication with up to 200 MicroLog or MicroLogPro data loggers. A simple plug and play operation requires a wireless cradle for each data logger and a MicroLog Receiver at the PC location. MicroLog Plus software is also ... Enabling wireless communication in this manner between multiple loggers and a single computer, eliminates the need to download data from each unit manually ...” <http://www.microdaq.com/fourier/wireless.php>

Microlog wireless system requires: datalogger, wireless transmitter cradle, wireless receiver and MicroLog software that supports wireless system. Dataloggers have a 7 digit segment LCD display, they are powered by internal lithium battery.

Table comparing differences between MicroLog and MicrologPro:

http://www.microdaq.com/fourier/microlog_micrologplus_comp.php

Prices for all Fourier Microlog products were taken from TheDataloggerStore

<http://www.microdaq.com/fourier/wireless.php>

Microlog (8bit)	\$149	http://www.fouriersystems.com/products/temp_humid_8bit/data_logger.php
Software	\$70	http://www.microdaq.com/fourier/software/microlab_deluxe.php
Transmitter	\$165	http://www.microdaq.com/fourier/accessories/wireless_cradle.php
Receiver	\$215	include power adapter, serial communications cable and whip antenna
Total	\$599	
3 loggers set	\$1,227	

MicrologPlus (10bit)	\$200	http://www.fouriersystems.com/products/temp_humid_10bit/data_logger.php
Software	\$70	http://www.microdaq.com/fourier/software/microlab_deluxe.php
Transmitter	\$165	http://www.microdaq.com/fourier/accessories/wireless_cradle.php
Receiver	\$215	include power adapter, serial cable and whip antenna
Total	\$650	
3 loggers set	\$1,380	

Microlog dataloggers can be used without wireless technology. They can unload data via IRDA interface to HP printer and PC or RS232 serial cable.

Microlog (8bit)	\$149	http://www.microdaq.com/fourier/microlog/temperature-humidity.php
Software w/cable	\$25	http://www.microdaq.com/fourier/software/microlab.php
Total	\$174	
3 loggers set	\$472	

MicrologPlus (10bit)	\$200	http://www.microdaq.com/fourier/microlog_plus/ec750.php
Software w/cable	\$25	http://www.microdaq.com/fourier/software/microlab.php
Total	\$225	
3 loggers set	\$625	

TH TempLog - Oakton Instruments

Cole-Palmer Technical Library - Wireless Dataloggers: What the Future Holds:

<http://www.coleparmer.com/techinfo/techinfo.asp?htmlfile=DataLFuture.htm&id=104>

“The most advanced dataloggers available today—precursors to tomorrow's units—utilize Spread Spectrum RF Technology, which uses special frequency bands of radio signals to transmit data over short distances between multiple dataloggers and a single receiver. This technology eliminates cabling and eliminates the need to collect dataloggers and download the data from each individually. Instead, the data from multiple remote units is automatically collected and stored simultaneously on one PC.”

List of complete TempLog Oakton wireless system

http://www.coleparmer.com/catalog/product_index.asp?cls=21938

RH TempLog	\$160	http://www.4oakton.com/proddetail.asp?parent=210&prod=205&seq=2&TotRec=2
Transmitter (+ battery, VAC adapter)	\$185	http://www.4oakton.com/proddetail.asp?parent=210&prod=342&seq=7&TotRec=2
Receiver (+software, VAC adapter, battery, USB/serial cable)	\$285	http://www.coleparmer.com/catalog/Product_view.asp?sku=3571035&px=EW
Total	\$630	
3 loggers set	1,320	

Same as MicroLog, Oakton TempLog can be used without wireless technology. They can unload data via IRDA interface to PC or RS232 serial cable.

TH TempLog kit (+software and cable)	\$160	http://www.coleparmer.com/catalog/product_view.asp?sku=3571010&px=EW
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HOBO dataloggers – Onset Computer Corporation

HOBO H14-001 Product specifications

<http://www.1800loggers.com/solutions/products/loggers/showloggerfamily.php5?lf=14&view=2>

The HOBO LCD Temperature/Relative Humidity (RH) Data Logger displays and record temperature and humidity conditions for use in manufacturing, processing, and storage environments. System requires BoxCar Pro 4.3 is a powerful Windows-based program with extensive features for graphing, data analysis, data export and simultaneous management of multiple loggers. The kit includes software, PC interface cable and software manual. Data is offloaded via serial cable to a PC which is included with software. PCs with only USB ports will require a USB adapter.

Hobo H14	\$199	http://www.1800loggers.com/solutions/products/loggers/_1oggerviewer.php5?pid=249
Software w/serial cable	\$99	BoxCar Pro http://www.1800loggers.com/solutions/products/software/index.php5?programid=3
Total	\$298	
3 loggers set	\$696	

HOBO U12-011 Product specifications:

http://www.1800loggers.com/solutions/products/loggers/_showloggerfamily.php5?lf=1&view=2

U12-011 model have option of HOBOWare Pro or basic HOBOWare Lite Software. HOBOWare Pro is part of Onset's next generation of software for logger management, data graphing, data analysis, and data export. Data Assistants and Real-Time Alarm Plug-ins provide advance data analysis and monitor/notification of out-of-range conditions. The full U12-011 system requires: datalogger and software (USB cable included with software).

Hobo U12	\$105	http://www.1800loggers.com/solutions/products/loggers/_1oggerviewer.php5?pid=360
Software w/cable	\$99	HOBOWare Pro http://www.1800loggers.com/solutions/products/software/index.php5?programid=1
Total	\$204	
3 loggers set	\$414	

HOBO U10 Product specifications:

http://www.1800loggers.com/solutions/products/loggers/_showloggerfamily.php5?lf=5&view=2

The U10-011 model also has option to run with HOBOWare Pro or Lite. HOBOWare Lite offers easy logger launch, readout, and data plotting. Includes both PC and Mac versions of the installer, and a USB interface cable for connecting loggers with a direct USB interface uploads data to PC via USB cable. The full U10-011 system requires: datalogger and software (USB cable included with software).

Hobo U10	\$69	http://www.1800loggers.com/solutions/products/loggers/_1oggerviewer.php5?pid=382
Software w/cable	\$39	HOBOWare Lite http://www.1800loggers.com/solutions/products/software/index.php5?programid=2
Total	\$108	
3 loggers set	\$246	

DICKSON**TP120 product specifications:**

http://www.dicksonweb.com/upload/1154612967_TP120_Spec_Sheet.pdf

From product info: “The TP 120 is a self-contained, low cost temperature and humidity datalogger equipped with internal sensors... User-friendly DicksonWare software makes it simple to integrate recorded temperature and humidity data into documents and spreadsheets ... “ Data is uploaded via RS-232 COM (serial) port. System includes datalogger and software with cable included in the price.

Dickson TP120	\$199	http://www.dicksonweb.com/product/model_TP120.php?display=spec#anch
Software w/cable	\$79	
Total	\$278	
3 loggers set	\$676	

TX 120 product specifications:

http://www.dicksonweb.com/upload/1154613114_TX120_Spec_Sheet.pdf

From product info: “TX120 is equipped with internal sensors ... battery powered.” TX120 model uses DicksonWare software and uploads data via 9 pin male D-shell to male 2.5mm stereo plug

Dickson TX 120	\$159	http://www.dicksonweb.com/product/model_TX120.php?display=spec#anch
Software w/cable	\$79	
Total	\$238	
3 loggers set	\$556	

Company info on dataloggers and environmental data collecting in general:

http://www.dicksonweb.com/product/model_type_content_1.php

HAXO-8 - LogTag

Product specifications:

<http://www.logtagrecorders.com/products/LogTag%20Humidity%20Recorder%20Product%20Specification.pdf>

From product info; “The LogTag downloads readings using LogTag Analyzer software which provides facilities for charting, zooming, listing data statistics and allows exporting the data to other applications such as Excel. LogTag's interface cradle design provides rapid and reliable LogTag data transfer via Logtag Analyzer software in a matter of

seconds; by far the fastest in it's class. Interface cradles are available in USB and RS232 connection versions. System requires datalogger, docking station and software. Price of docking station is included in price of software.”

Price for all components from TheDataLoggerStore web site

<http://www.microdaq.com/logtag/haxo-8.php>

HAXO-8 TH	\$68	http://www.logtagrecorders.com/index.html (system) f
Software w/docking station	\$48	http://www.logtagrecorders.com/products/software.htm
Total	\$116	
3 loggers set	\$252	

EL-USB-2 - Lascar Electronic

Product: <http://www.lascarelectronics.com/PRODUCTS.CFM?STOCKNO=EL-USB-2>

From product info: “This data logger measures and stores up to 16,382 relative humidity and 16,382 temperature readings.... The user can easily set up the logging rate and start time, and download the stored data by plugging the module straight into a PC's USB port and running the purpose designed software under Windows 98, 2000 or XP... Data can then be graphed, printed and exported to other applications. The data logger is supplied complete with a long-life lithium battery, which can typically allow logging for a year.”

EL-USB-2 w/software	\$80	http://www.lascarelectronics.com/data/pdf/EL-USB-2.pdf
3 loggers set	\$240	

Dataloggers of following two companies are mentioned in number of articles and e-mails. However there is no information about prices of their products available on the internet.

Spectrum 2000 - VERITEQ

Product info: <http://www.veriteq.com/humidity-temperature-data-loggers/index.htm>

From product info: “Spectrum 2000 palm-size humidity data loggers are completely self-contained and battery-operated. They interface to any PC (through any serial or USB port) with Spectrum Software, a powerful windows-based package for configuring, downloading, displaying, analyzing and reporting collected humidity and temperature information. The logger can also be used with the Spectrum Excel add-in, a free utility program designed to work directly within Microsoft Excel.

Veriteq also offers a Palm connectivity solution, Veriteq sGo, that allows you set up, view real-time readings, and download data from Spectrum 2000's using a Palm handheld. If on-

going monitoring and alarming of connected data loggers is required, such as would be possible across an Ethernet network, the Veriteq viewLinc software can be used.”

Software info: <http://www.veriteq.com/data-loggers/spectrum-data-logger-software.htm>

Networked Monitoring: <http://www.veriteq.com/networked-data-loggers/system-diagram.htm>

Veriteq sGo: <http://www.veriteq.com/sgo-palm-data-logging/index.htm>

Ultra low TH model: <http://www.veriteq.com/humidity/low-humidity.htm>

SmartReader-002 - ACR Systems Inc.

Product page: <http://www.acrsystems.com/products/smartreader2>

Product specifications: <http://www.acrsystems.com/products/smartreader2/specs.pdf>

From product info: “The SmartReader 2 data logger has a built-in temperature sensor, a plug-in relative humidity sensor and is equipped with two extra channels to connect either ACR's temperature/RH probe or thermistor probes. The RH plug-in sensor is field replaceable so you can always be assured of continuous recording. The SmartReader 2 is excellent for monitoring air quality conditions.”

Glossary

RS232 is a standard for serial binary data interconnection between a *DTE* (Data terminal equipment) and a *DCE* (Data Circuit-terminating Equipment). It is commonly used in computer serial ports. More:

<http://www.veriteq.com/data-loggers/serial-logger-interface-cable.htm>

USB is a widely used hardware interface for attaching peripheral devices replacing the serial and parallel ports on a PC. More:

<http://www.veriteq.com/usb/index.htm>

LAN is acronym for a local area network (LAN) - a computer network covering a local area. More: http://en.wikipedia.org/wiki/Local_area_network

IRDA - a standard for communication between devices (such as computers, PDAs and mobile phones) over short distances using infrared signals. More about IR communications <http://www.answers.com/topic/ir-remote-control>

RF the term may be used to contrast wireless transmission systems that do not require line of sight with those that do. For example, an RF remote control does not require line of sight to the device it is controlling. More about RF:

<http://www.answers.com/topic/rf>

Appendix B: Comparison table

	RH accuracy	Temperature range in F	Output	Sampling points	Sampling rate	LCD	Battery type	Price logger	Price Full Sys	Price 3 loggers
PEM IPI	1%	-67 to 257	memory card			yes	lithium	\$650	\$1,250	\$2,550
ID Pinnacle (8 bit)	2%	0 to 150	internet	15,000	1-30min	no	AC	\$675	\$675	\$2,025
MicrologPlus (10bit)	3%	-40 to 176	RF/cable/IRDA	26,000	10sec-2hr	yes	lithium	\$200	\$650	\$1,380
TempLog Oakton	3%	-22 to 122	RF/cable/IRDA	16,000	10sec-2hr	yes	lithium	\$160	\$630	\$1,320
Microlog TH (8bit)	3%	-22 to 122	RF/cable/IRDA	8,000	10sec-2hr	yes	lithium	\$149	\$599	\$1,227
H14 Hobo	3%	-4 to 122	Serial cable	65,170	1sec-9h	yes	AAA	\$199	\$298	\$696
TP120 Dickson	2%	-40 to 176	Serial cable	32,000	10sec-24h	no	lithium	\$199	\$278	\$676
TX120 Dickson	5%	-40 to 176	Serial cable	7,680	10sec-24h	no	lithium	\$159	\$238	\$556
U12 Hobo	3%	-4 to 158	USB cable	43,000	1sec-18h	no	lithium	\$105	\$204	\$414
HAXO-8 LogTag	5%	-40 to 185	docking station	16,000	30sec-hours	no	lithium	\$68	\$116	\$252
U10 Hobo	3.5%	-4 to 158	USB cable	52,000	1sec-12h	no	lithium	\$69	\$108	\$246
USB-2 Lascar	3.5%	-31 to 176	USB port/LAN	32,764	10sec-12h	no	lithium	\$80	\$80	\$240
ARC SR-002	4%	-40 to 158	Serial cable	32,767	8s-5day	no	lithium			
Veriteq SP-2000	2%	-40 to 176	serial/LAN	21,500	10sec-1day	no	lithium			

Appendix C: Environmental Monitoring links

Environmental Monitoring – general info

Conservation OnLine <http://palimpsest.stanford.edu/bytopic/environment/>

Massachusetts Environmental Monitoring in Info. Contact: Gregor Trinkaus-Randall.
<http://mblc.state.ma.us/advisory/preservation/monitoring.php>

Solinet http://www.solinet.net/preservation/preservation_templ.cfm?doc_id=115

Environmental Monitoring - bibliographies

Environmental Control Bibliography
<http://preserve.harvard.edu/bibliographies/environmentalcontrol.html>

Libraries and Archives Canada: Environmental Control reference list
<http://www.collectionscanada.ca/8/14/r14-205-e.html>

Supplier list

Conservation OnLine Suppliers
<http://palimpsest.stanford.edu/misc/commercial.html#supplier>

Solinet Preservation Services Providers <http://www.solinet.net/emplibfile/environsuppl.pdf>